TRƯỜNG ĐH BÁCH KHOA – ĐHQG-HCM KHOA KH&KT MÁY TÍNH	BÀI KT GIỮA KỲ		Học kỳ/Năm học	1	2020-2021
			Ngày KT		04-11-2020
	Môn học	Mô hình hóa Toán học			
	Mã môn học	CO2011			
	Thời lượng	70 phút	**Mã đề**		**7121**

Ghi chú: - SV được phép sử dụng 01 tờ giấy A4 viết tay có chứa ghi chép cần thiết.
- **SV phải ghi MSSV, họ và tên vào cuối trang này và nộp lại đề thi cùng với bài làm.**
- Tô đậm phương án trả lời đúng vào phiếu làm bài trắc nghiệm.
- Bài thi có **20** câu hỏi trắc nghiệm, mỗi câu có điểm số là **0.5**.

Câu 1. (L.O.1.2)
Given the following program. With $\{a \geq 2\}$ is a precondition, which of the following is the post condition?

```
y = 2; x = a; z = true;
while (y < x)
  if (x % y == 0)
    z = false;
    break;
  }
  else
    y = y + 1;
```

(A) $\{a$ is prime$\}$.
(B) $\{z = (a$ is prime$)\}$.
(C) $\{\text{true} = (a$ is prime$)\}$.
(D) $\{z \equiv (a$ is prime$)\}$.

Câu 2. (L.O.1.2)
With a precondition, the program and the postcondition given in Question 3. In order to prove the partial correctness of the corresponding Hoare triple, which of the following is an invariant form we should use?

(A) $(0 \leq x^2 < a) \wedge y = (x+1)^2$.
(B) $(0 < x^2 \leq a) \wedge y = (x+1)^2$.
(C) $(0 \leq x^2 \leq a) \wedge y = (x+1)^2$.
(D) $(0 < x^2 < a) \wedge y = (x+1)^2$.

Câu 3. (L.O.1.2)
Given the following program. With

$$\{a \geq 0\}$$

is a precondition, which of the following is the post condition?

```
{a ≥ 0}
x = 0; y = 1;
while (y <= a)
 {
   x = x + 1;
   y = y + 2*x + 1;
 }
{0 ≤ x^2 ≤ a < (x + 1)^2}
```

(A) $\{0 \leq x^2 < a \leq (x+1)^2\}$.
(B) $\{0 < x^2 < a \leq (x+1)^2\}$.
(C) $\{0 \leq x^2 \leq a < (x+1)^2\}$.
(D) $\{0 < x^2 \leq a < (x+1)^2\}$.

Câu 4. (L.O.1.2)
With notions and terminology defined as in Question 7. Which of the following is incorrect?

(A) $\models \neg wp(P, \neg\phi) \rightarrow wp(P, \phi)$.
(B) If $\models \phi \rightarrow \psi$ then $\models wp(P, \phi) \rightarrow wp(P, \psi)$.
(C) $\models_{\text{par}} (\!|\phi|\!)$ P $(\!|\psi|\!)$ if and only if $\models \phi \rightarrow wp(P, \psi)$
(D) If $\models wp(P, \phi) \rightarrow wp(P, \psi)$ then $\models \phi \rightarrow \psi$.

Câu 5. (L.O.1.2)

Given the following program, where we use $\div$ to denote *integer division*, which always rounds down, i.e.

$$n \div m = \lfloor \frac{n}{m} \rfloor.$$

With $\top$ is a precondition, determine the post-condition yourself. In order to prove the partial correctness of the corresponding Hoare triple, which of the following is an invariant form we should use?

$x := X;$
$n := N;$
$r := 1;$
while $n \geq 1$ **do**
  if $2 \mid n$ **then**
    $x := x \times x$
    $n := n \div 2$
  else
    $r := x \times r;$
    $x := x \times x;$
    $n := (n - 1) \div 2;$

(A) $r = X^N$.
(B) $r = X^{N-n}$.
(C) $rx^n = X^N$.
(D) $r = x^n$.

Câu 6. (L.O.1.2)

Given the following program. With

$$\{a > 0 \land b > 0\}$$

is a precondition, which of the following is the post condition?

```
x = a; y = b;
while (x != y)
  if (x > y)
    x = x-y;
  else
    y = y-x;
```

(A) $\{y = \gcd(a, b)\}$.
(B) $\{x = \gcd(a, b) \lor y = gcd(a, b)\}$.
(C) $\{x = \gcd(a, b)\}$.
(D) $\{x = y = \gcd(a, b)\}$.

Câu 7. (L.O.1.2)

A formula ϕ is *weaker than* formula ψ if $\psi \to \phi$. Given a set of formulas $\{\phi_1, \phi_2, ...\}$, ϕ_i is the *weakest* formula in the set if $\phi_j \to \phi_i$ for all j. Given a program P and a formula ψ, denote $wp(P, \psi)$ the *weakest precondition* ϕ such that $\models_{\text{par}} (\!|\phi|\!)\ P\ (\!|\psi|\!)$. Moreover, we define $wp(P\ S, \psi) = wp(P, wp(S, \psi))$. Which of the following is correct?

(A) $wp(x := x + y; y := x * y,\ x < y) \equiv ((-y < x < y) \to (y < 1))$.
(B) $wp(x := x + y; y := x * y,\ x < y) \equiv ((-y < x < y) \to (y > 1))$.
(C) $wp(x := x + y; y := x * y,\ x < y) \equiv ((x > -y) \to (y > 1)) \land ((x < -y) \to (y < 1))$.
(D) $wp(x := x + y; y := x * y,\ x < y) \equiv ((x > -y) \to (y < 1)) \land ((x < -y) \to (y > 1))$.

Câu 8. (L.O.1.2)

With a precondition, the program and the postcondition given in Question 6. In order to prove the partial correctness of the corresponding Hoare triple, which of the following is an invariant form we should use?

(A) $x - y = \gcd(a, b)$.
(B) $y - x = \gcd(a, b)$.
(C) $\gcd(x, y) = \gcd(a, b)$.
(D) $\gcd(x, y)$.

Câu 9. (L.O.1.2)

Given the following program. With

$$\{a > 0 \land b > 0\}$$

is a precondition, which of the following is the post condition?

```
x = a; y = b; z = 1;
while (y != 0)
  if (y % 2 == 1) { /* y is odd */
    y = y - 1;
    z = x*z;
  }
  else {
    x = x*x;
    y = y / 2;
  }
```

(A) $\{z = b^a\}$.
(B) $\{z = a * b\}$.
(C) $\{z = a^b\}$.
(D) $\{z = a + b\}$.

Câu 10. (L.O.1.2)

With a precondition, the program and the postcondition given in Question 9. In order to prove the partial correctness of the corresponding Hoare triple, which of the following is an invariant form we should use?

(A) $z = xy$.
(B) $z = x^y$.
(C) $zx^y = a^b$.
(D) $z = y^x$.